Do woody legumes use flammability to promote their persistence?

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Background

To successfully occupy Australia, the indigenous flora has adapted characteristics allowing their species to survive particular fire regimes. However, atypical fires could obliterate a population, thus it has been hypothesised plants produce fuels that promote a fire regime that supports their regeneration (1).

Woody legumes populate most ecosystems in Australia. They are important to replace soil nitrogen lost during fire, but considerable phosphorous is needed to achieve this (3). After fire, woody legumes may persist in communities for decades or only a few years, which significantly affects the fuel they contribute. In addition, most legume seeds need heat to germinate, but their optimal temperatures differ. Therefore, do legume flammabilities provide the heat their seeds require? How do they alter their flammability? Finally, does phosphorous availability alter their persistance?

Hypotheses to be tested

1) The heat produced when a woody legume is consumed corresponds to optimal temperature required to break dormancy of its seeds.

2) Woody legumes are more flammable when they are less dominant in a plant community.

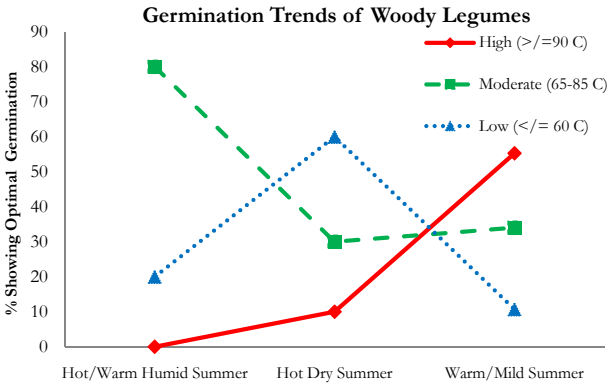
3) Legume and ecosystem phosphorous status is related to fire regime, particularly soon after fires.

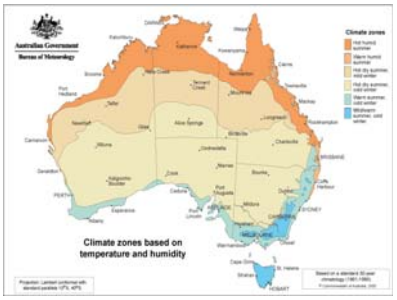
Methods

1. Compare optimal germination temperatures between woody legume seeds from different fire regimes.
2. Determine proportions of woody legumes in communities according to time-since-fire, soil phosphate, and plant phosphate and nitrogen concentrations.
3. Determine ratio of live vs dead standing biomass for ephemeral and persistent woody legumes, and combust their litterfall to determine the relative flammabilities.
4. Determine foliar chemistry and flammability from plants grown under different phosphate concentrations.

Significance

Fire service and land managers who know how much fuel woody legumes are contributing can use this data to predict respective fire danger for different communities. This will aid their continued efforts to apply a fire regime that balances the risks from fire against the health of plant communities.





A meta-analysis of Australian legume germination literature suggests the optimum temperature to break seed dormancy varies according to temperature and humidity zones (see map from [4]). Fires must be moderate or high-intensity to produce ≥ 60° C temperatures 2 cm deep in soil (2).

Acacia longifolia var *longifolia* growing clustered(A) or singly(B) in Garigal NP, Sydney.

Do legumes exhibit a more flammable structure when they are less dominant in a plant community?

References

1. Mutch, R. W. (1970). *Wildland fires and ecosystems – a hypothesis.* **Ecology.** 51:1046-1051.

2. Auld, T. D. (1986). *Population dynamics of the shrub Acacia suaveolens (Sm.) Willd.: Fire and the transition to seedlings.* **Australian Journal of Ecology**. 11:373-385.

3. Wang, Y-P., Houlton, B. Z., et al. (2008). *A unifying framework for dinitrogen fixation in the terrestrial biosphere.* **Nature**. 454:327-331.

4. Bureau of Meteorology (2005, 24 August 2010). *Climate zones based on temperature and humidity.* **Australian Climate Averages - Climate classifications**. Retrieved 04 May, 2011, from http://reg.bom.gov.au/jsp/ncc/climate_averages/climate-classifications/index.jsp?maptype=tmp_zones

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